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Anchor et al.

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[45] **Date of Patent: Mar. 28, 2000**

[54] **FILL SYSTEM FOR PARTICULATES**

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[73] Assignee: **Tetra Laval Holdings & Finance, SA**, Pully, Switzerland

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[22] Filed: **Apr. 30, 1998**

[51] **Int. Cl.**[7] **B65B 3/06**; B65B 29/00; B65B 39/00

[52] **U.S. Cl.** ..... **53/473**; 53/266.1; 53/437; 141/275; 141/311 A

[58] **Field of Search** ..... 53/474, 473, 525, 53/437, 267, 268, 274, 284.5, 266.1, 271; 141/67, 172, 105, 101, 275, 253, 374, 311 A, DIG. 2

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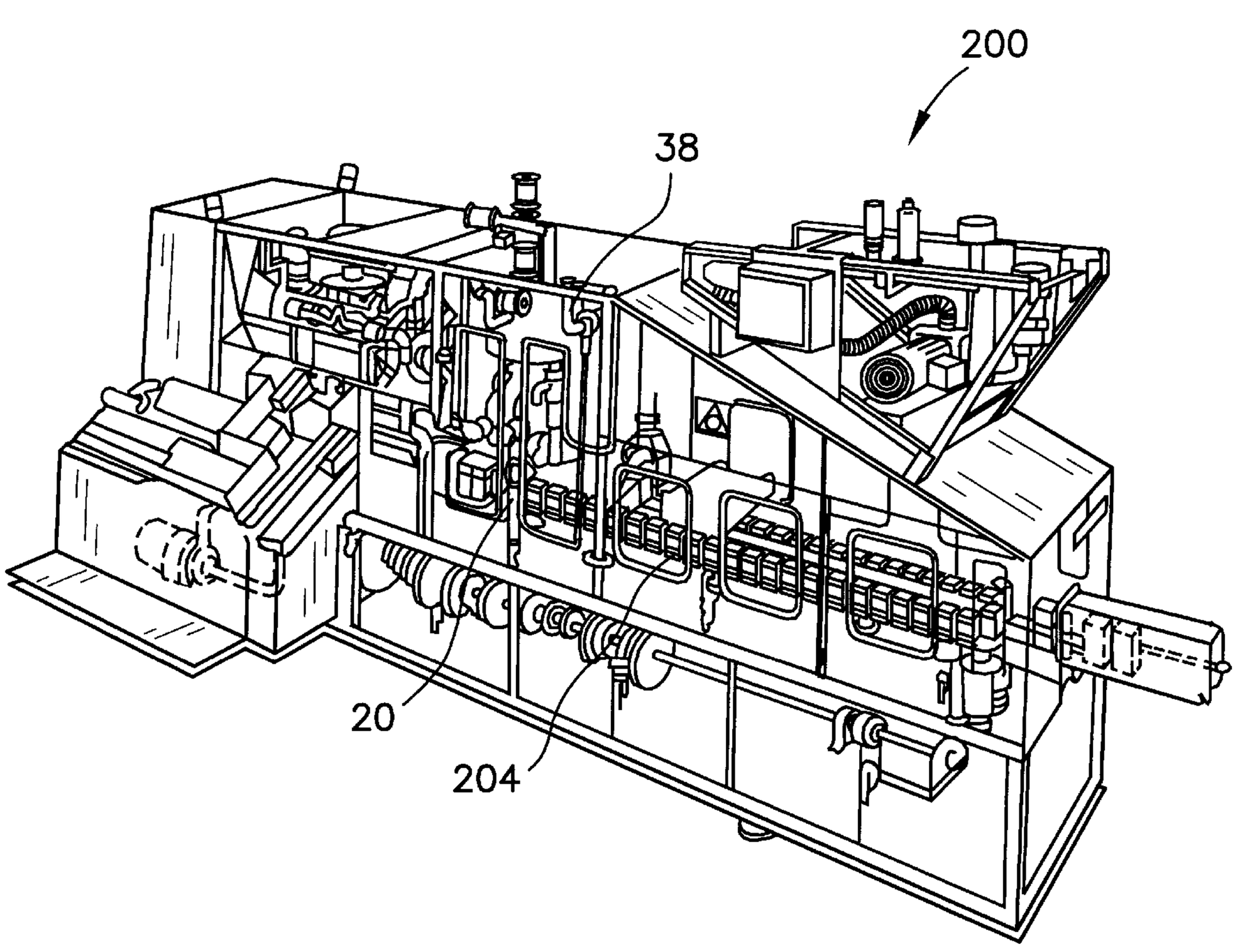
Primary Examiner—James F. Coan
Attorney, Agent, or Firm—Welsh & Katz, Ltd.

[57] **ABSTRACT**

A filling system for filling soup into gable top cartons is disclosed wherein the dripping of soup from the fill tube is substantially diminished by the present invention. The filling system includes a product tank, a knife-gate valve, a pump mechanism, a fill tube with a circumferential recessed area, and a sealing cone with a cutting edge. The cutting edge of the sealing cone prevents particulates from interfering with the sealing of the fill tube by the sealing cone. The knife-gate valve prevents the flow of product from the product tank during filling of a carton. The product tank may have an agitating means for evenly distributing the particulates throughout the soup.

16 Claims, 13 Drawing Sheets



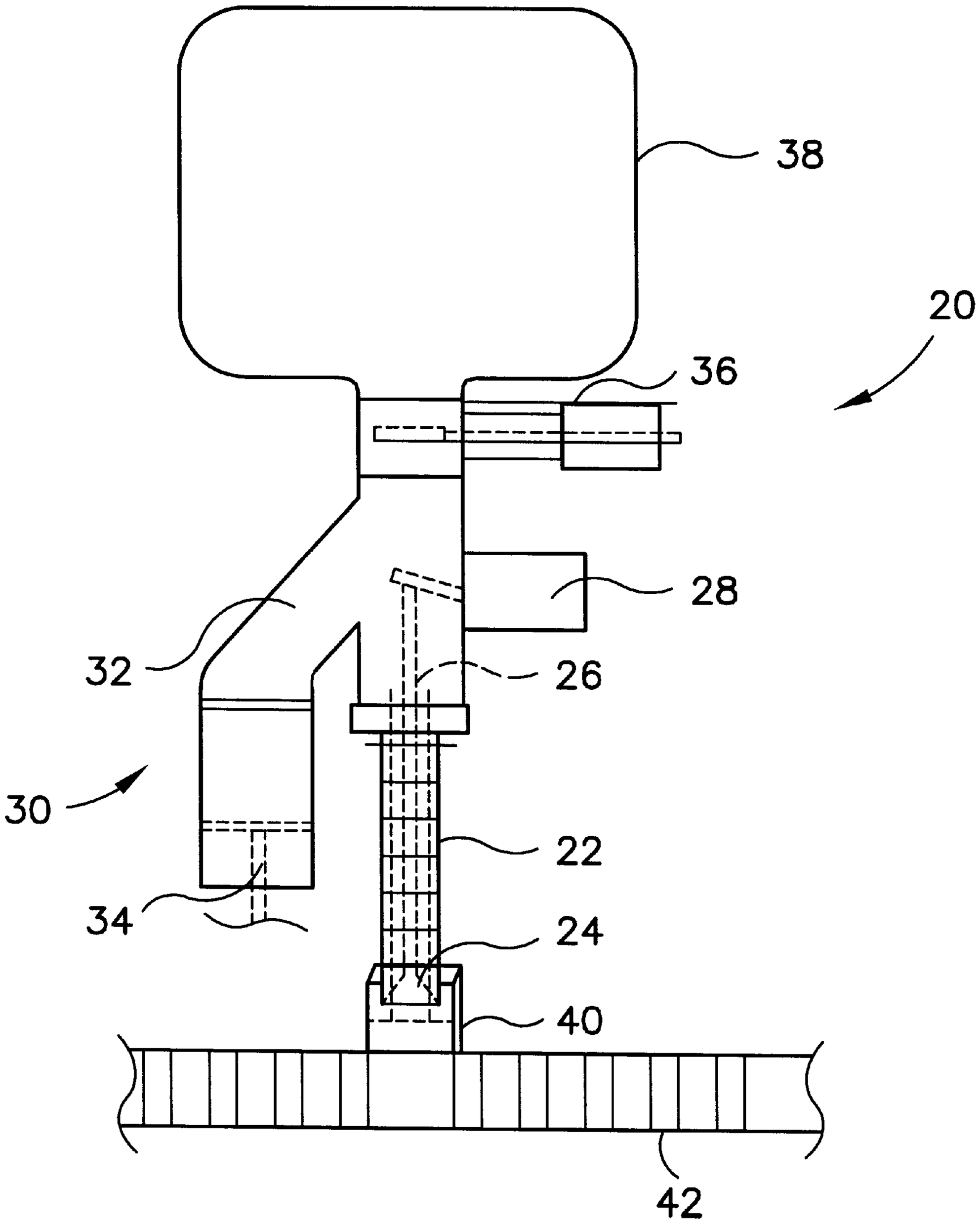


FIG. 1

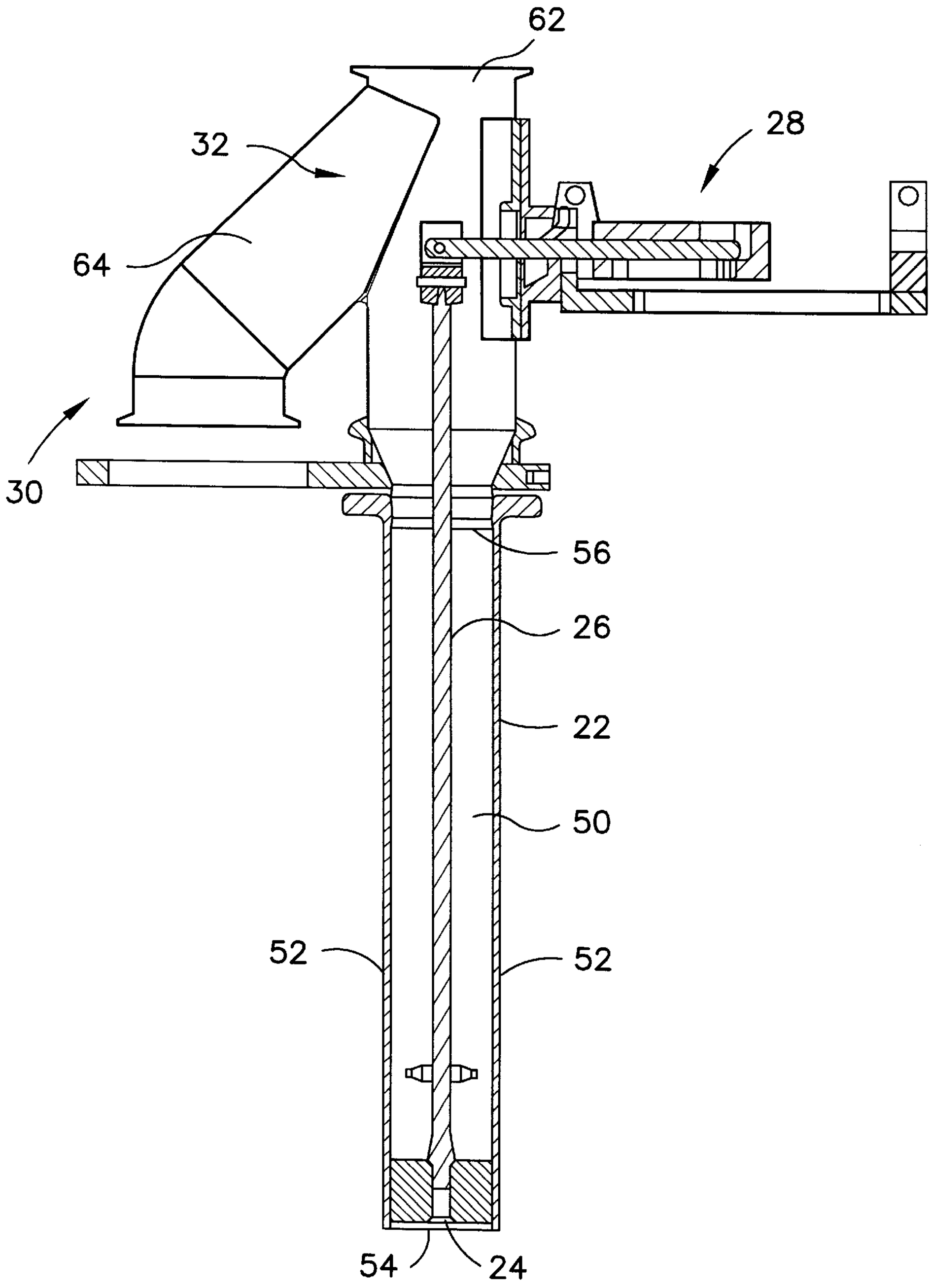


FIG. 2

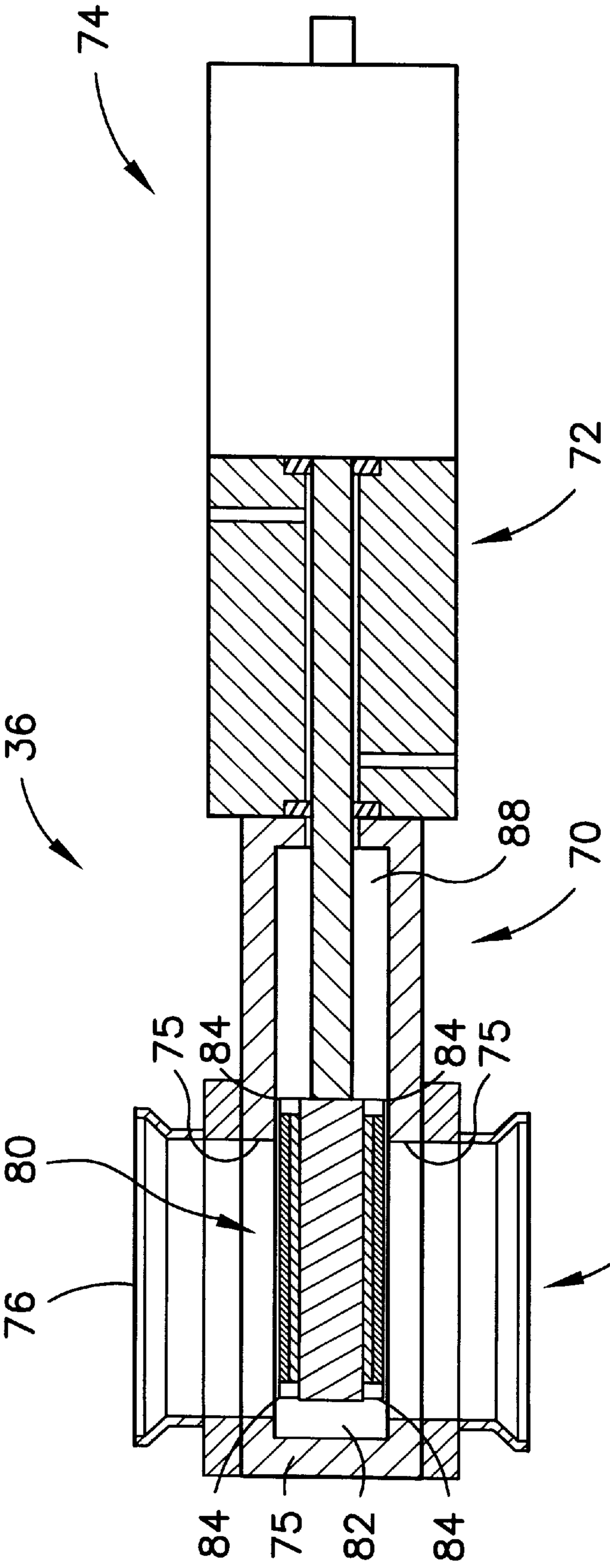


FIG. 3

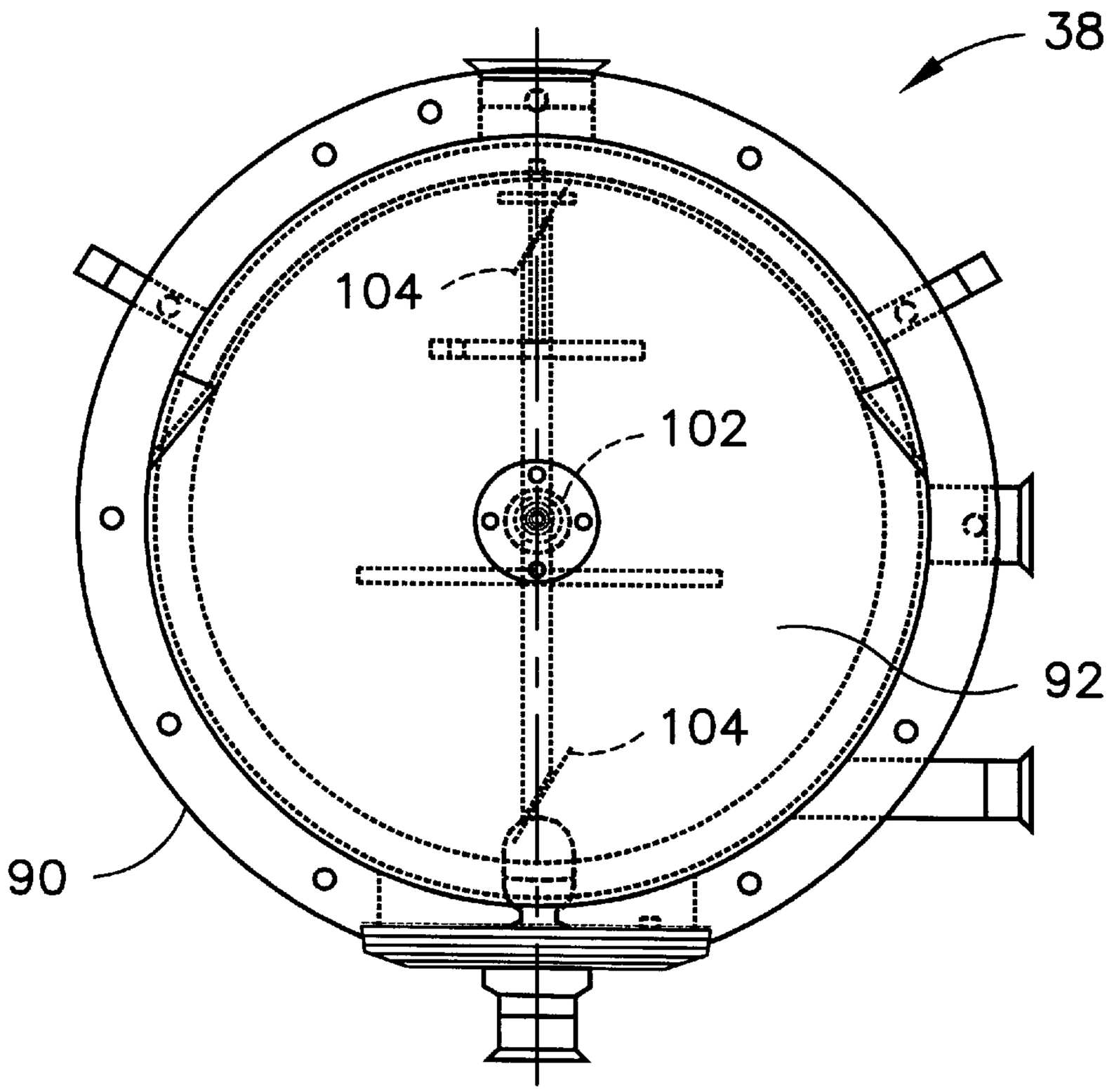


FIG. 5

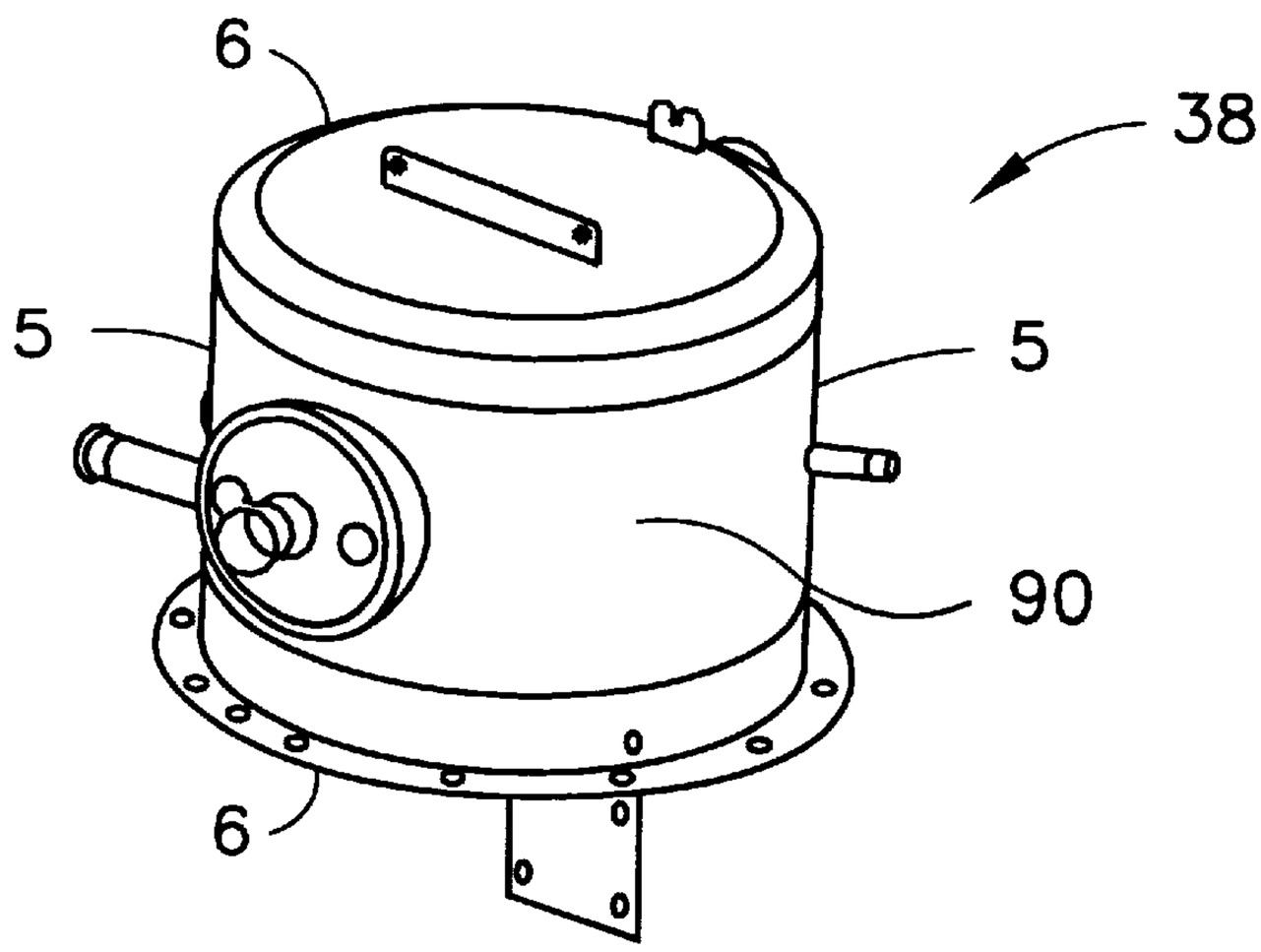


FIG. 4

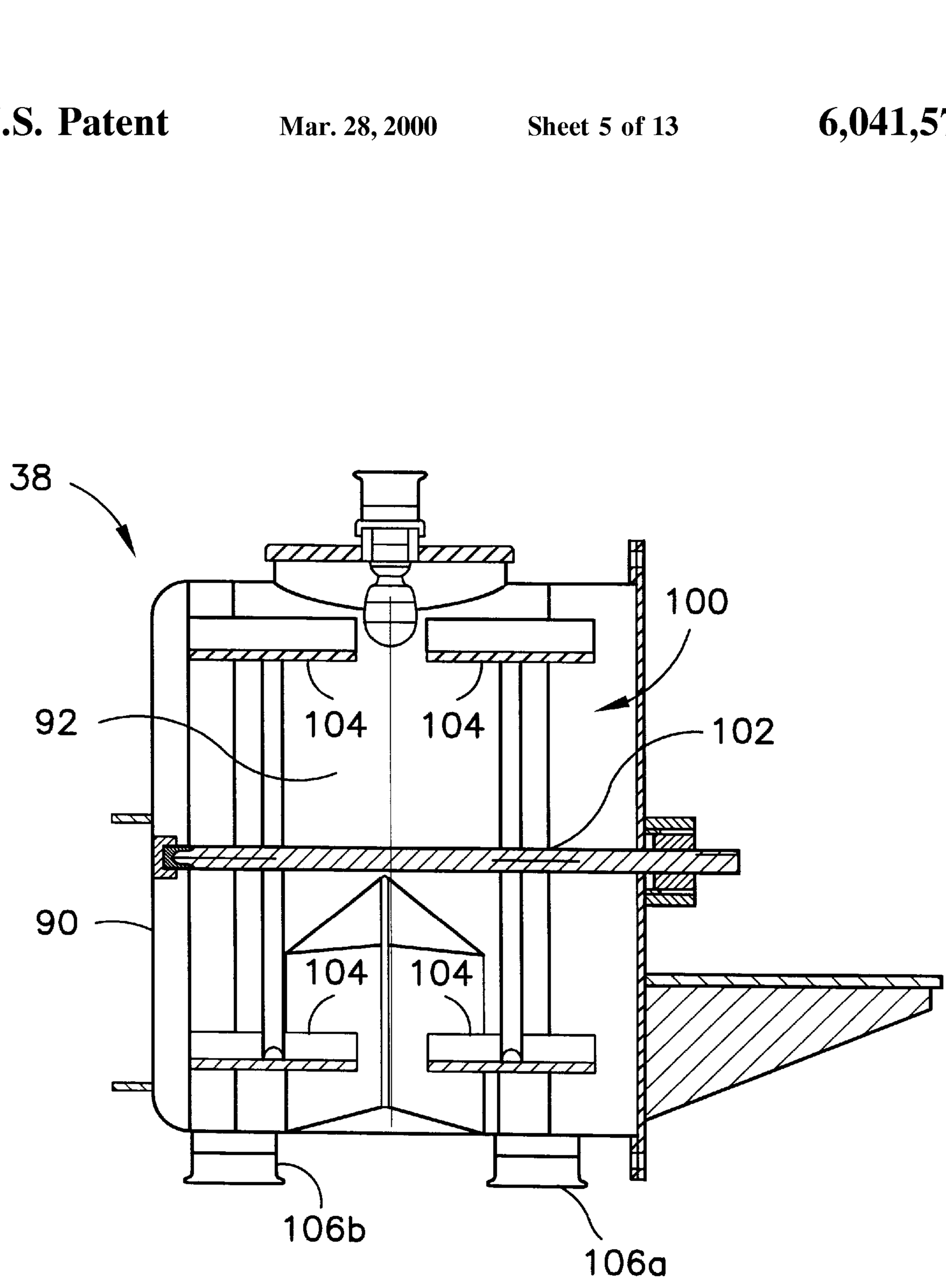


FIG. 6

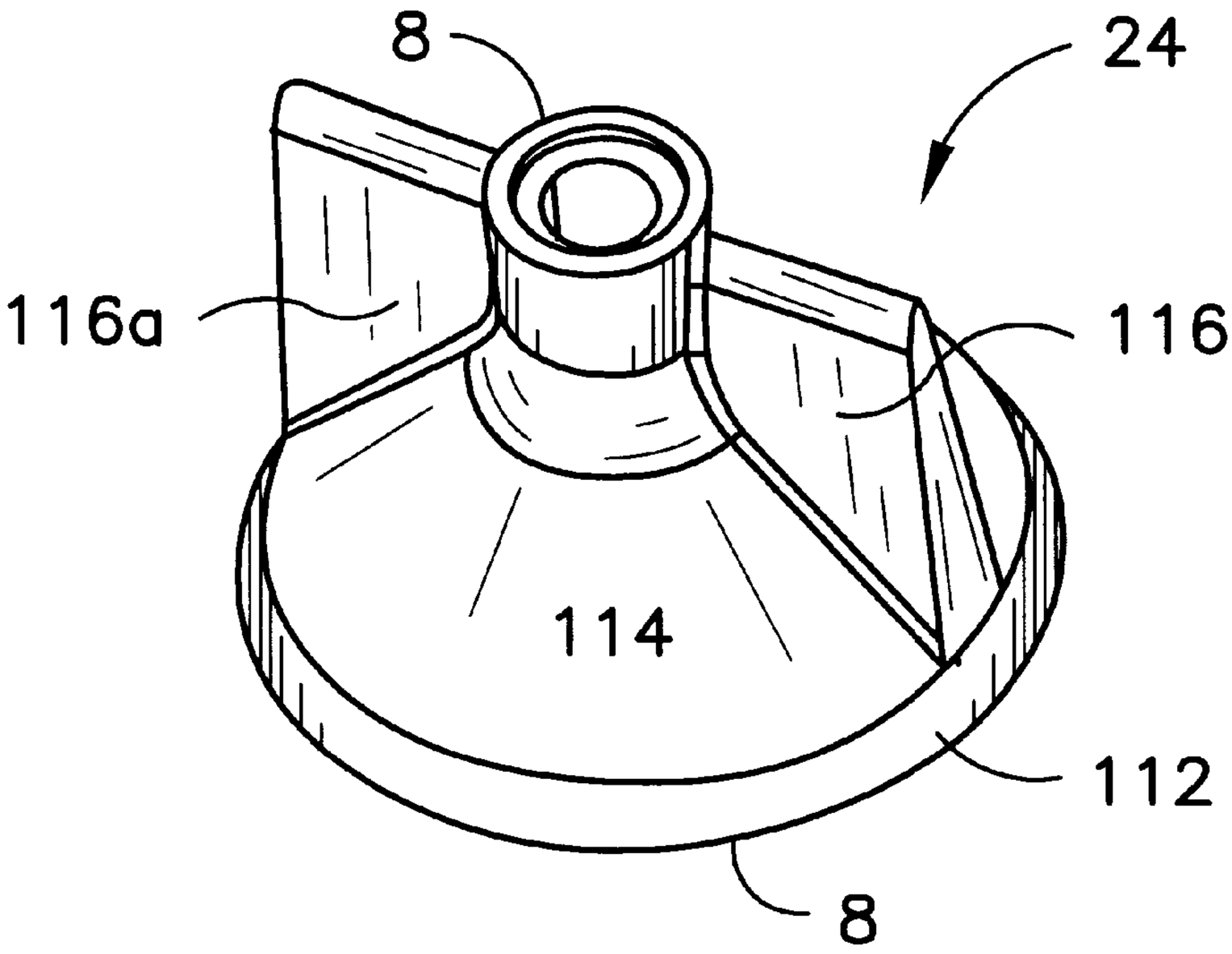


FIG. 7

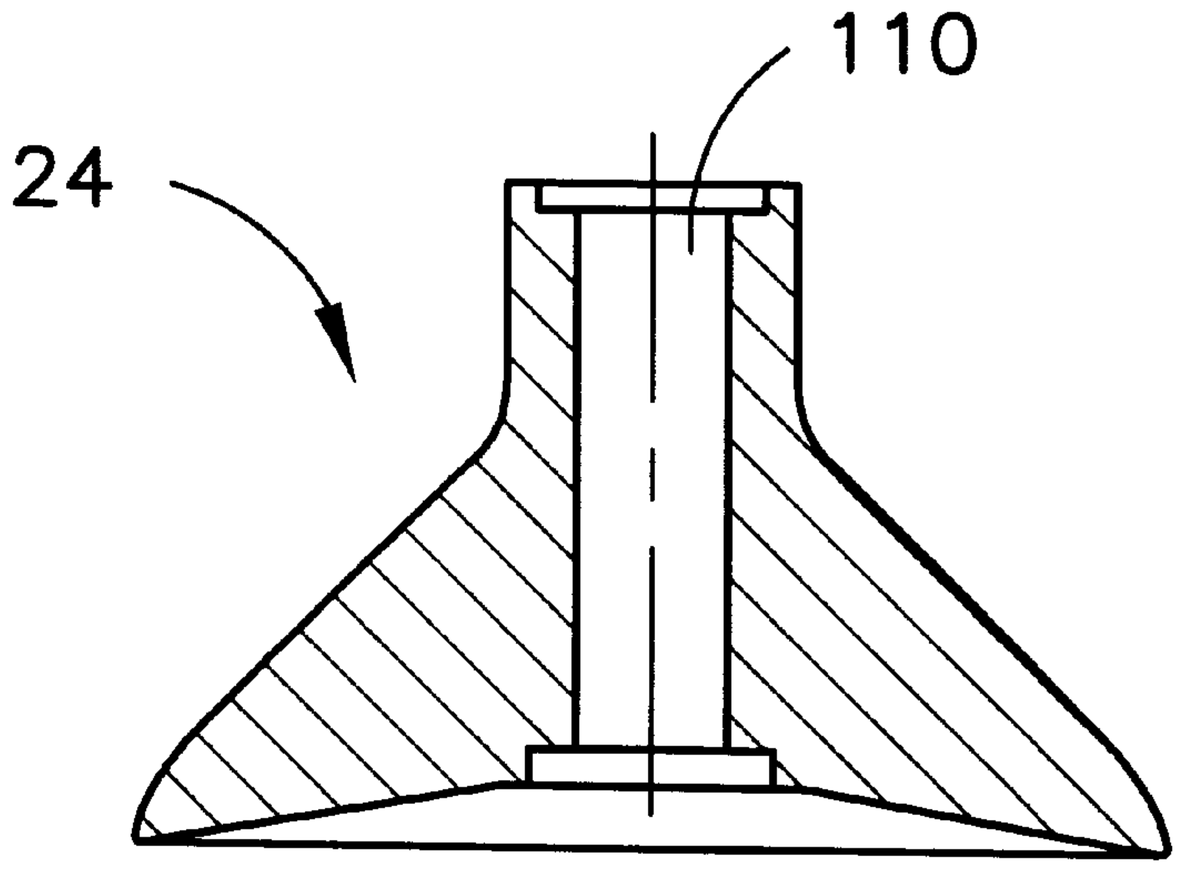


FIG. 8

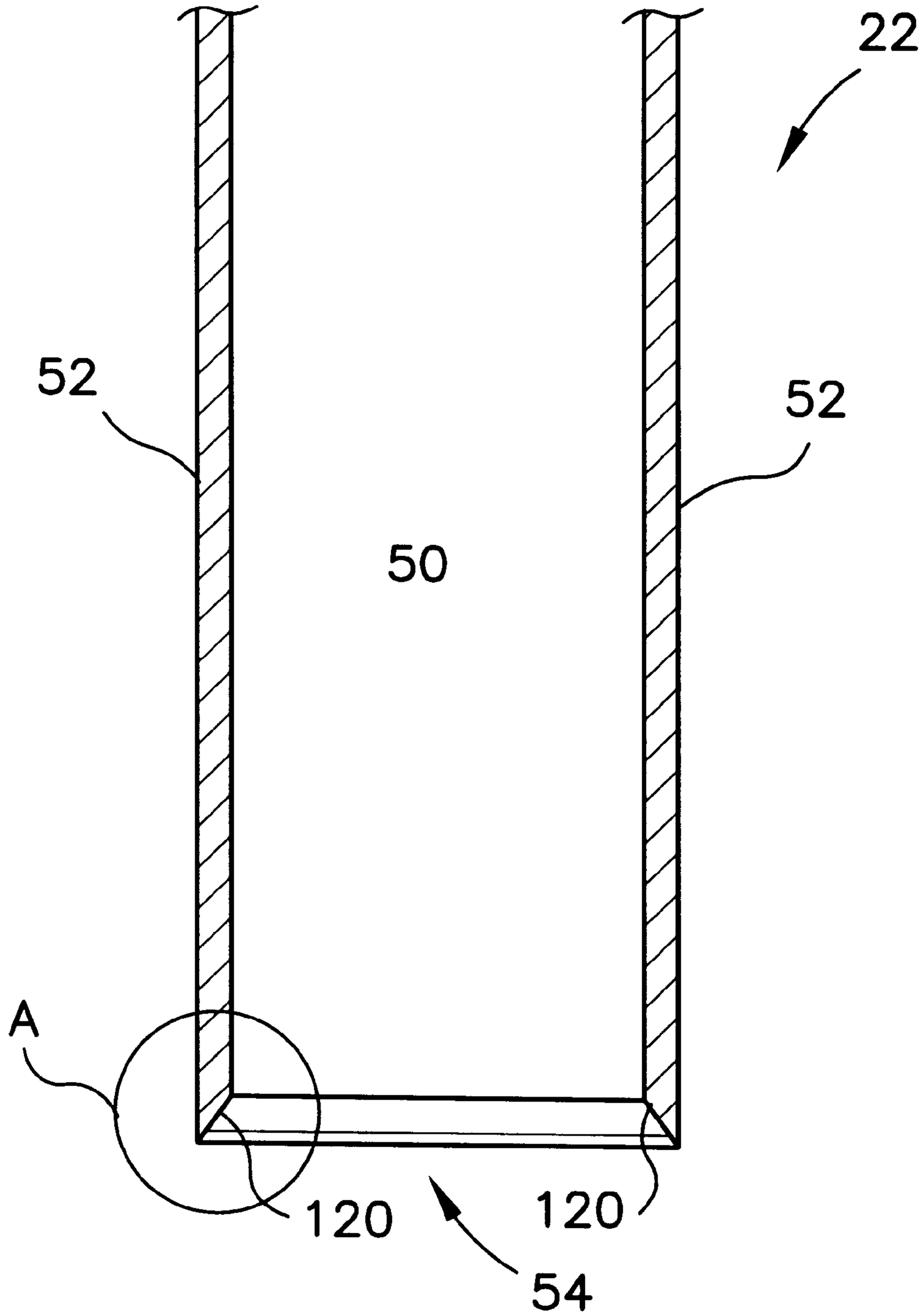


FIG. 9

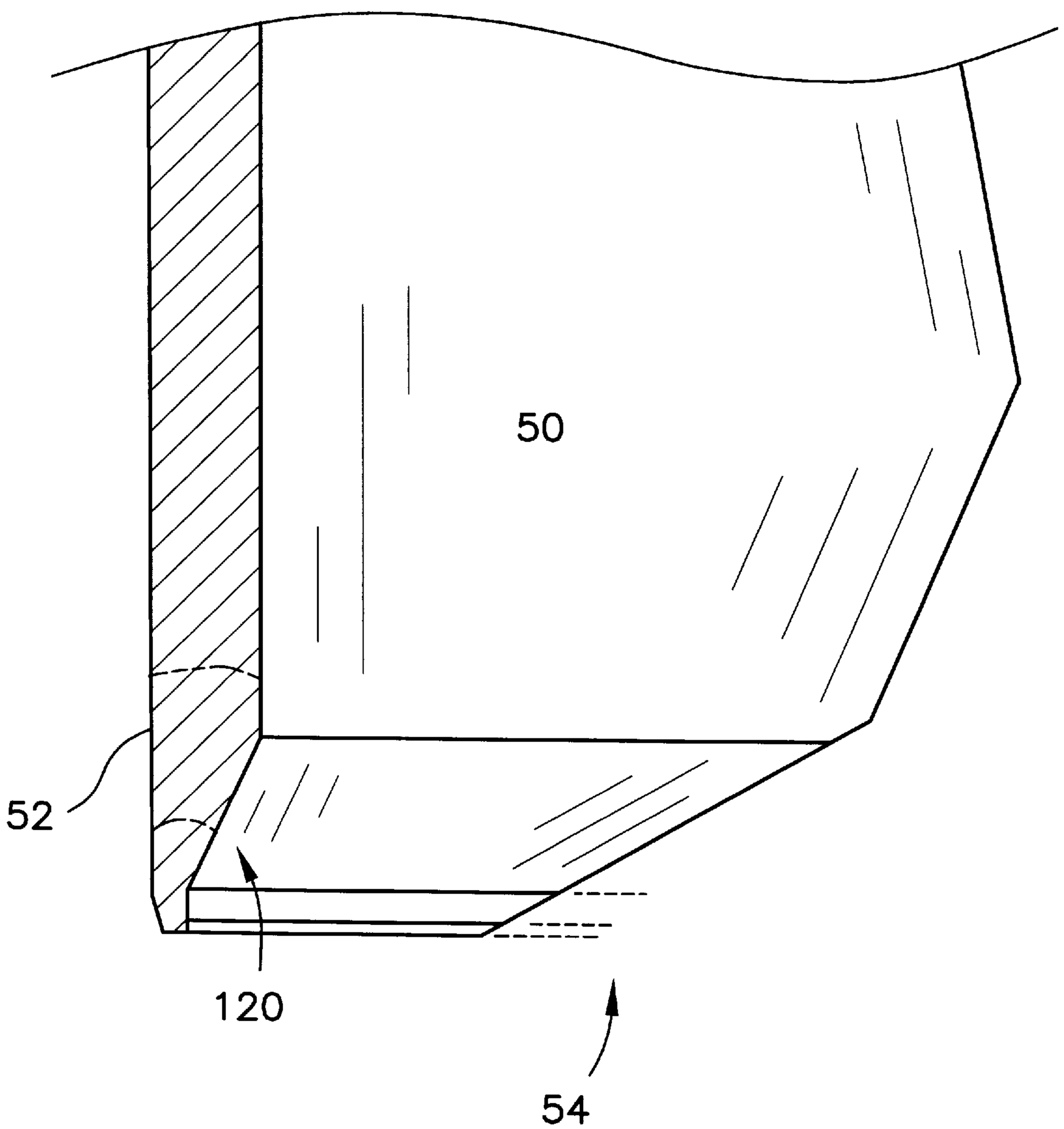


FIG. 10

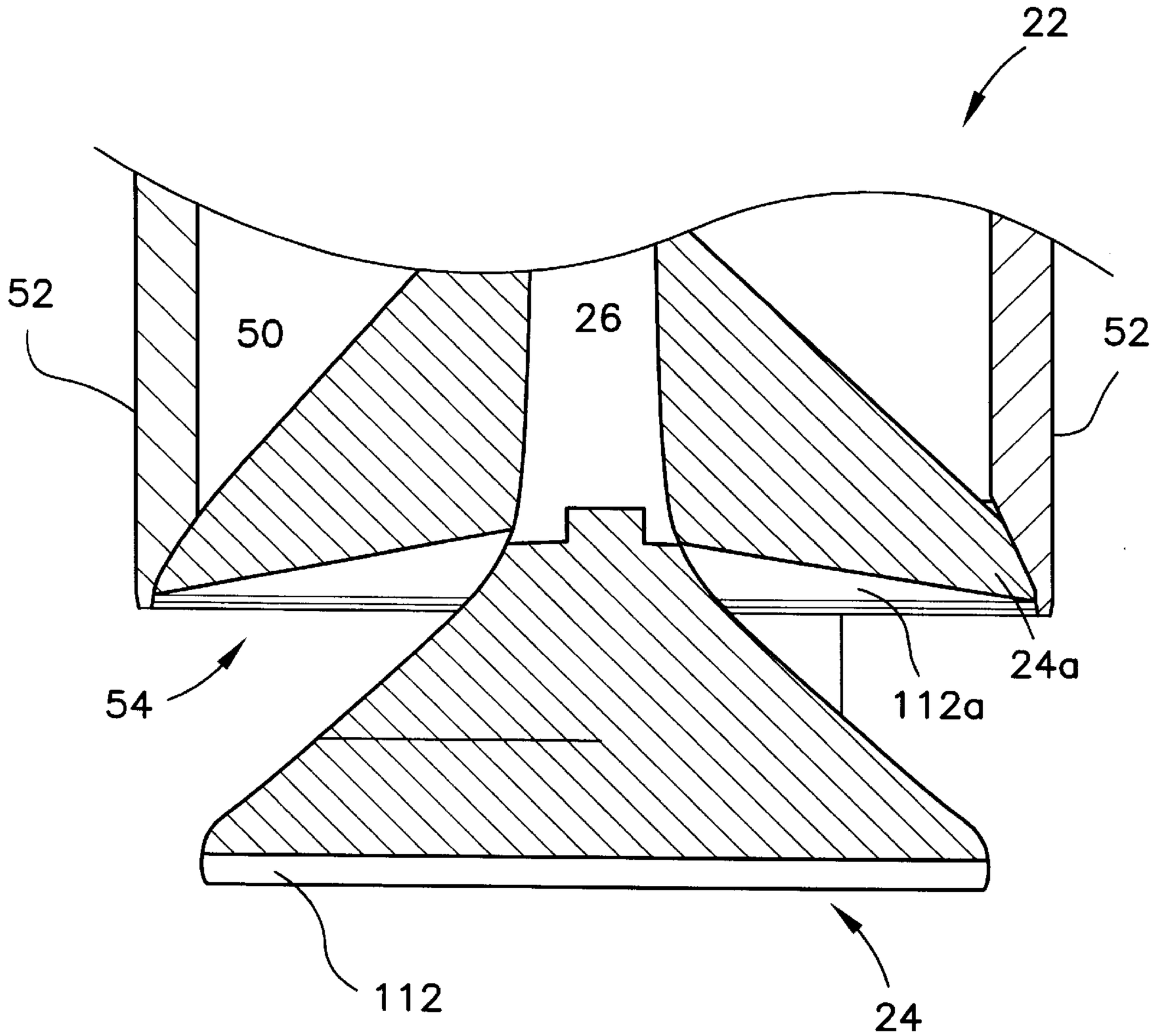


FIG. 11

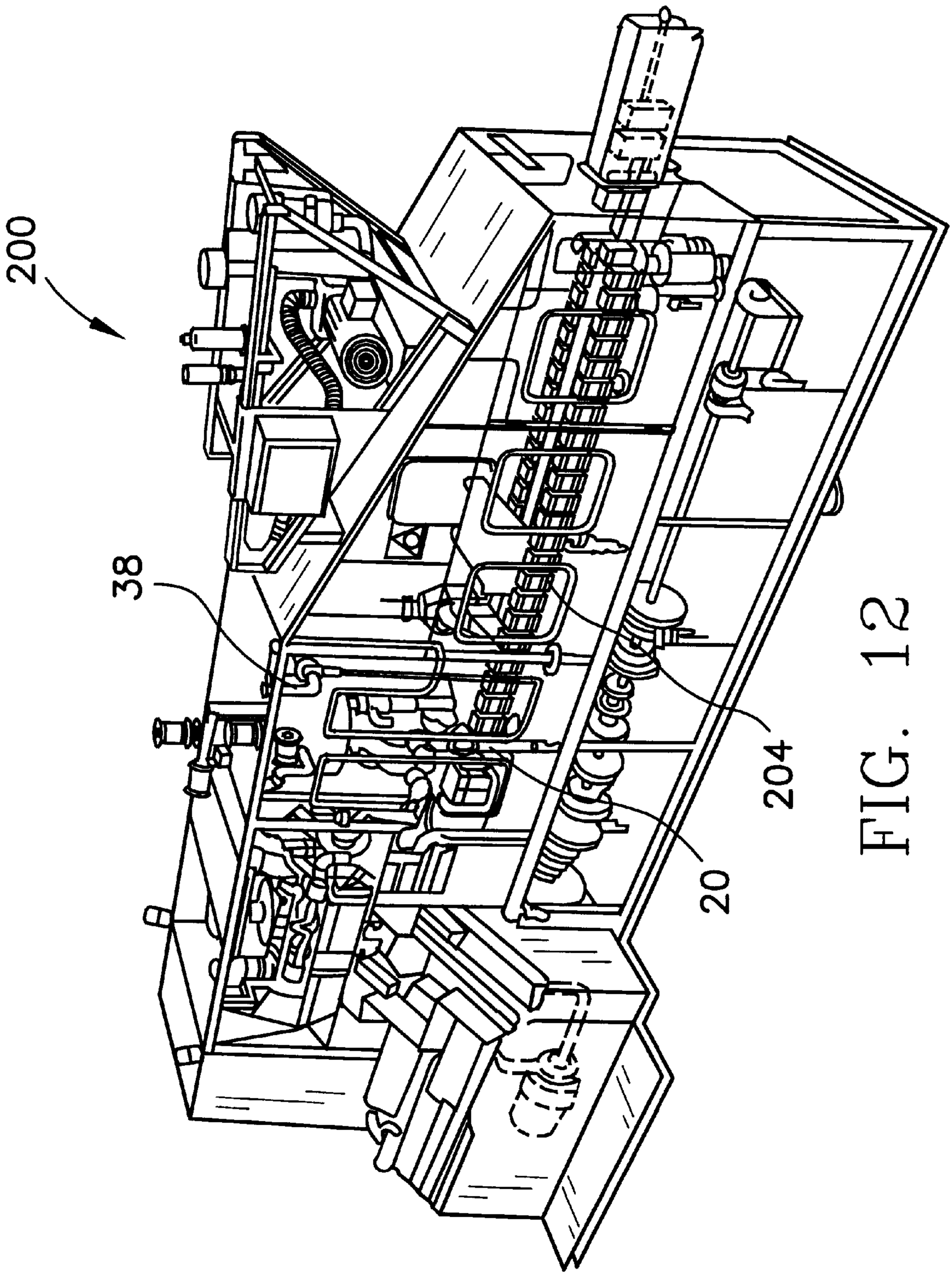


FIG. 12

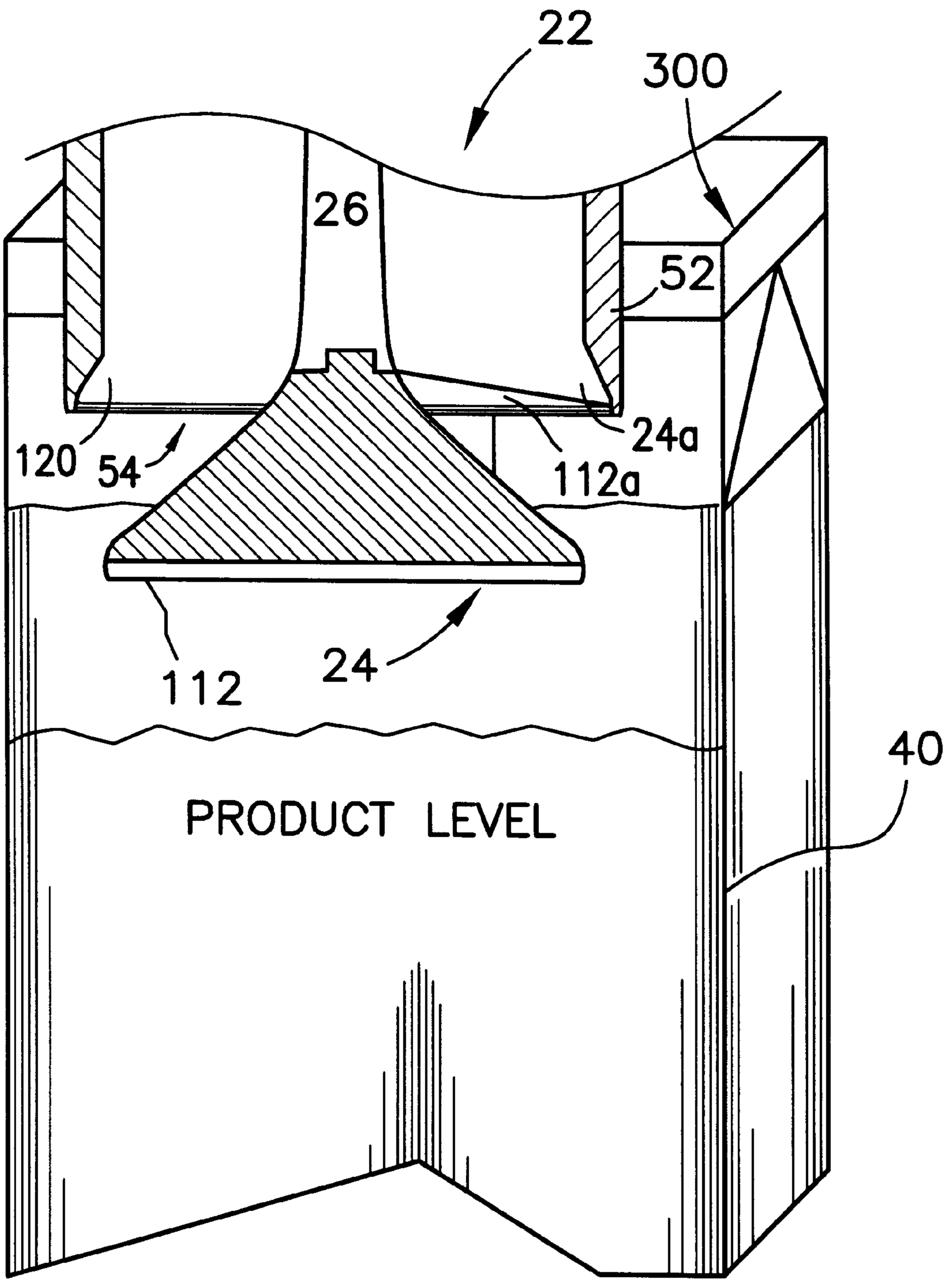


FIG. 13

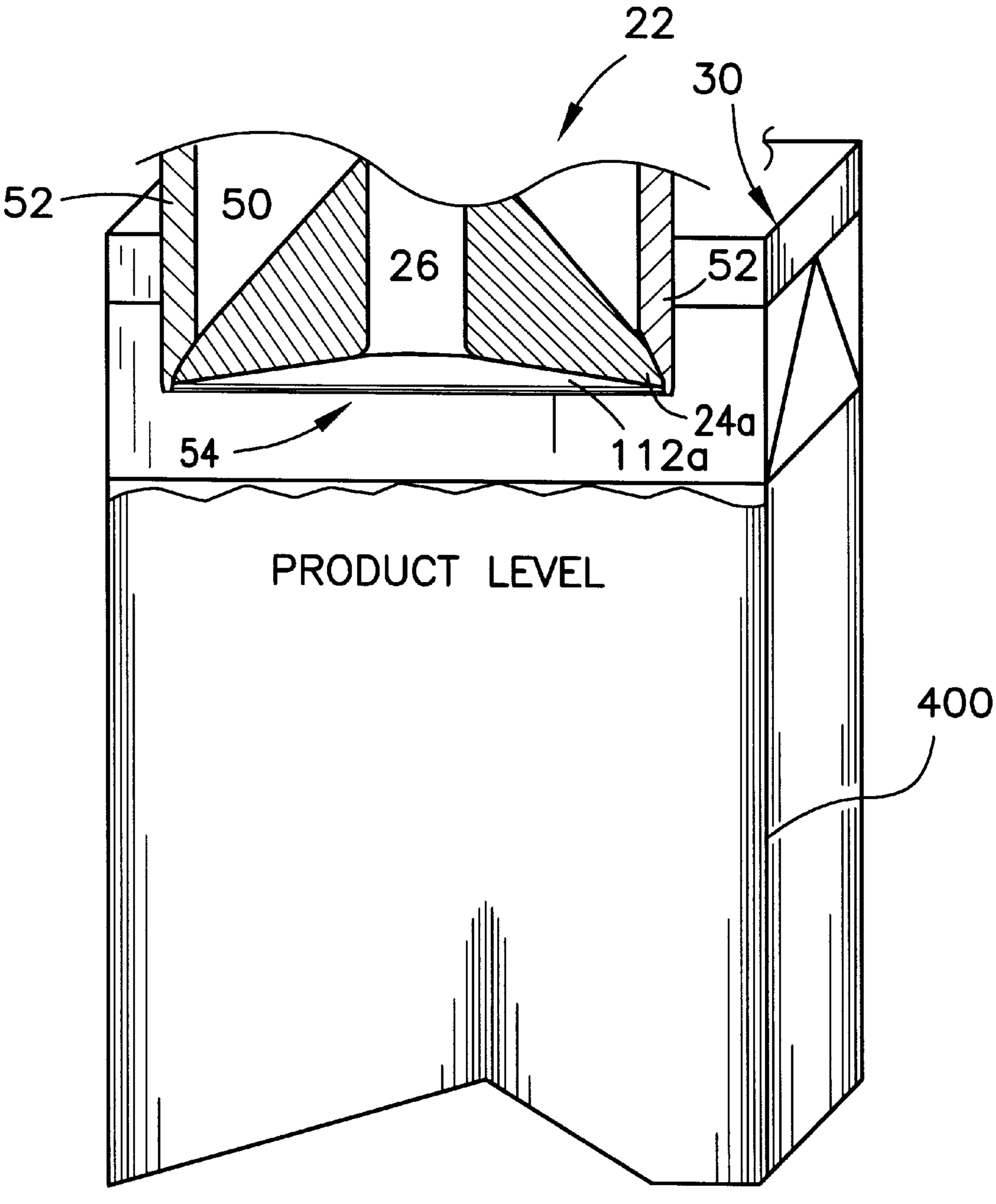


FIG. 13A

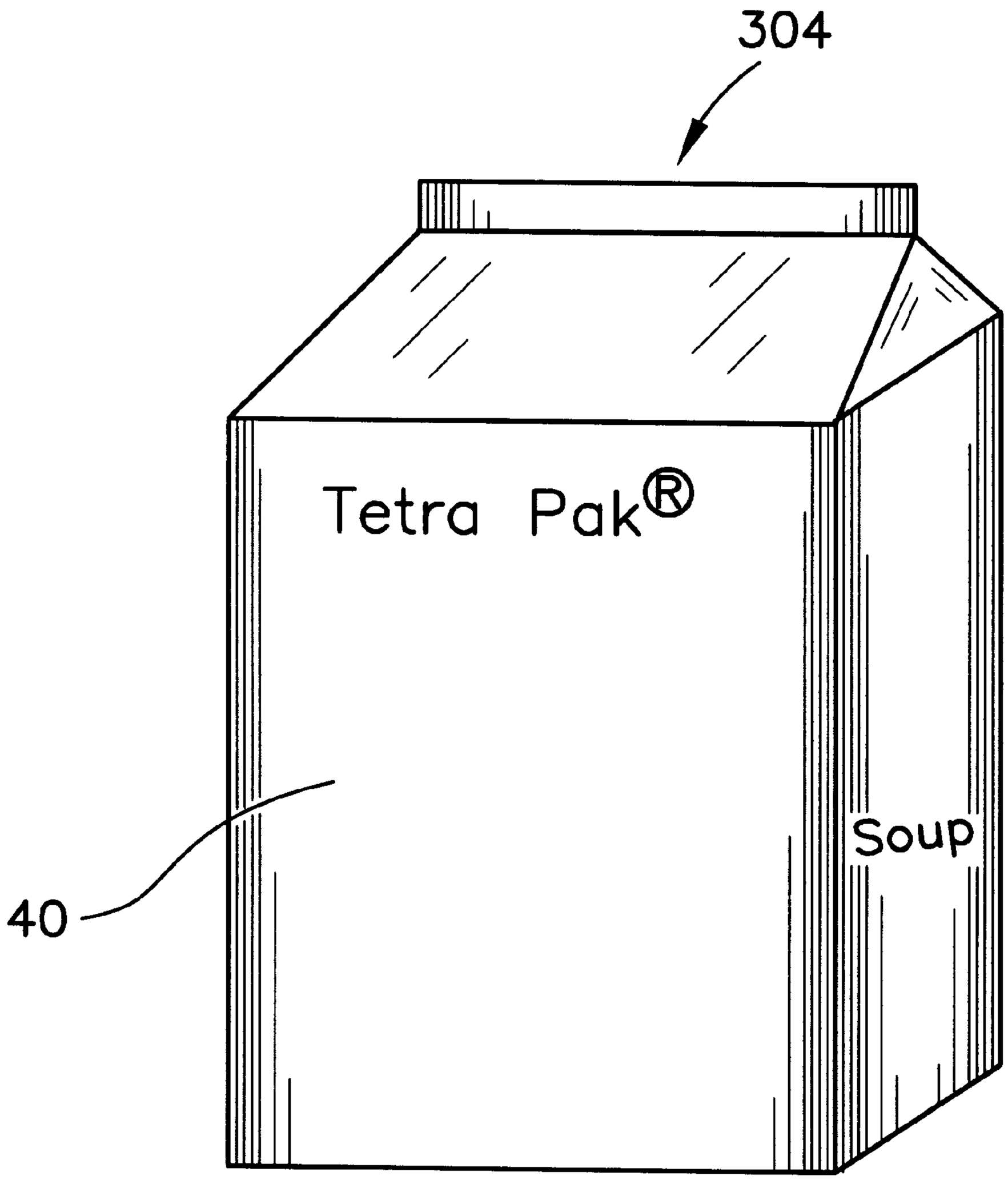


FIG. 14

FILL SYSTEM FOR PARTICULATES

CROSS REFERENCES TO RELATED APPLICATIONS

Not Applicable

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

Not Applicable

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to filling systems for packaging machines. Specifically, the present invention relates to a filling system for filling particulates into a carton being conveyed on a form, fill and seal packaging machine.

2. Description of the Related Art

Packaging machines are known that integrate into a single unit the various components necessary to form a container, fill the container with a liquid product, and seal the container. Such packaging machines typically feed carton blanks into the machine, seal the bottoms of the cartons, fill the cartons with a product dispensed from a product storage tank, seal the tops of the cartons, and off-load the filled cartons for shipping.

A popular type of carton is an Extended Shelf Life ("ESL") carton due to the added value such a carton presents to a retailer. For example, pasteurized milk processed and packaged under typical conditions has a shelf life at four degrees Celsius of seven to fourteen days while the same milk processed and packaged under ESL conditions has a shelf life of fourteen to thirty days. Under ESL conditions, juice may have a shelf life of forty to one hundred twenty days, liquid eggs sixty to ninety days, and egg nog forty-five to sixty days. Thus, ESL packaging greatly enhances a product since it extends the time period that the particular product may be offered for sale to the consuming public. An ESL carton is the final component of an ESL system that entails ESL processing and ESL filling. In order to have ESL filling, the filling system should be kept sterile in order to prevent contamination of the product or carton during filling on a form, fill and seal package machine.

Recently, the packaging of soups in cartons has become popular in the food industry. In order to have soup cartons with an extended shelf life, the sealing of the carton must be tight. The dripping of soup onto the seal area of a carton will have an adverse effect on the seal, thereby rendering the product defective. One major cause of dripping is the lack of proper closure between a nozzle and a fill pipe. The improper closure arises from particulates in the soup preventing full closure.

Another problem with filling liquid products having particulates, such as soup, is providing an even distribution of particulates throughout the liquid portion. Without overcoming this problem, each carton would have a different quantity of particulates to liquid.

BRIEF SUMMARY OF THE INVENTION

The present invention is able to overcome the problem with filling particulates in a carton by providing a novel filling system. The present invention also provides for an even distribution of particulates throughout the liquid portion.

One aspect of the present invention is a filling system for filling cartons with a liquid product with particulates therein

such as soup. The cartons are conveyed along a predetermined path by means of conveyor belt or the like. The filling system includes a fill pipe, a sealing cone, a pump, a knife gate valve and a product tank. The fill pipe is disposed above the predetermined path and has a dispensing end and an inlet end. The dispensing end has a circumferential recessed portion. The sealing cone has a linkage through the fill pipe to a control mechanism. The sealing cone has a cutting edge that mates with the circumferential recessed portion of the fill pipe to prevent dripping and to cut-off any lingering particulates. The pump mechanism has a pump chamber in flow communication with the fill pipe and a piston. The product tank holds the liquid product with particulates and is in flow communication with the pump chamber. The knife-gate valve is juxtaposed between the product tank and the pump chamber. The knife-gate valve controls the flow of liquid product with particulates from the product tank to the pump chamber. The product tank may have a means for agitating the liquid product with particulates.

Another aspect of the present invention is a packaging machine having the filling system as described above thereon. Yet another aspect of the present invention is a method for filling a container with a liquid product having particulates.

Having briefly described this invention, the above and further objects, features and advantages thereof will be recognized by those skilled in the pertinent art from the following detailed description of the invention when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

Several features of the present invention are further described in connection with the accompanying drawings in which:

There is illustrated in FIG. **1** a schematic view of the filling system of the present invention;

There is illustrated in FIG. **2** an isolated cross-sectional view of the fill pipe, transfer pipe and sealing cone with linkage of the filling system of the present invention;

There is illustrated in FIG. **3** the knife-gate valve of the filling system of the present invention;

There is illustrated in FIG. **4** an isolated perspective view of the product tank of the filling system of the present invention;

There is illustrated in FIG. **5** an isolated front view of the product tank of FIG. **4**;

There is illustrated in FIG. **6** an isolated cross-sectional view of the product tank along line **6—6** of FIG. **4**;

There is illustrated in FIG. **7** an isolated top perspective view of a sealing cone of the filling system of the present invention;

There is illustrated in FIG. **8** a cross-sectional view of th e sealing cone along line **8—8** of FIG. **7**;

There is illustrated in FIG. **9** an isolated cross-sectional view of the fill pipe of the filling system of the present invention;

There is illustrated in FIG. **10** an enlargement of circle A of FIG. **9**; and

There is illustrated in FIG. **11** an isolated cross-sectional view of the sealing cone and fill pipe of the filling system of the present invention in an open position and in a superimposed closed position;

There is illustrated in FIG. **12** a perspective view of a packaging machine with the filling system of the present invention thereon;

There is illustrated in FIG. **13** an isolated view of a carton in relation with the sealing cone and fill tube during filling of the carton with product from the filling system of the present invention;

There is illustrated in FIG. **13**A an isolated view of a carton in relation with the sealing cone and fill tube of the present invention immediately after the filling operation has been completed for this carton;

There is illustrated in FIG. **14** a top perspective view of a sealed carton filled with product from the filling system of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

As shown in FIG. **1**, a filling system is generally designated **20**. The filling system includes a fill pipe **22**, a sealing cone **24** having a linkage **26** to a control mechanism **28**, a pump mechanism **29** with a pump chamber **30**, transfer pipe **32** piston **34**, a knife-gate valve **36** and a product tank **38**. A carton **40** is conveyed below the filling system **20** by a conveyor means **42**.

As shown in FIG. **2**, the linkage **26** for the sealing cone **24** is disposed within the fill pipe **22** and a portion of the transfer pipe **32**. The fill pipe **22** is generally cylindrical and has a hollow interior **50** defined by a continuous wall **52**. The fill pipe **22** has a dispensing end **54** and an inlet end **56**. Each of the ends **54** and **56** are open thereby allowing for the flow of a product through the fill pipe **22**.

The sealing cone **24** is attached to the linkage **26** near the dispensing end **54** of the fill pipe **22**. In a closed position, the sealing cone **24** seals the dispensing end **54** of the fill pipe **22** thereby preventing the flow of product therethrough. In an open position, the sealing cone **24** is lowered away from the dispensing end **54** thereby allowing for product to flow into a container positioned below. The sealing cone is actuated by a control mechanism **28** via the linkage **26**. The control mechanism may be controlled by a programmable logic controller ("PLC") **60** which coordinates the opening and closing of the sealing cone **24** with the other operations of the filling system **20**.

The inlet end **56** of the fill pipe **22** is in flow communication with the transfer pipe **32** of a pump mechanism **29**. The transfer pipe **32** may be divided into a first portion **62** and a second portion **64**. The first portion **62** is parallel with the fill pipe **22** and the second portion **64** is angled to the first portion **62**. The piston **34** lies in the second portion **64**. A part of the linkage **26** lies within the first portion **62**. The pump mechanism **29** provides the internal pressure to the filling system **20** to pump the product out of the fill pipe **22** and into a container **40** below. The upward and downward motion of the piston **34** creates the pressure differentials inside the pump chamber **30**, the transfer pipe **32** and fill pipe **22**. The upward motion of the piston **34** forces the product from the dispensing end **54** and into a container **40**. Of course, during this upward motion of the piston **34**, the sealing cone **24** is an open position.

As shown in FIG. **3**, the knife gate valve **36** has a valve housing **70**, a condensed water chamber **72** and a pneumatic cylinder **74**. The valve housing **70** has an inlet **76** and an outlet **78** to a hollow cavity **80** defined by interior walls **75**. Inside the hollow cavity **80** is the valve member **82**. The valve member **82** is connected to the pneumatic cylinder **74** which provides for forward and rearward movement of the valve member **82**. The valve member **82** has O-rings **84**, the O-rings encapsulated within a fluoroplastic seal, to provide a tight seal against the interior walls **75** when the valve member **82** is in a closed position to prevent product flowing from the product tank **38** to the transfer pipe **32**. In the open position, the valve member **82** is moved rearward to a retraction cavity **88** thereby allowing for the unhindered flow of product from the product tank **38** to the transfer pipe **32** through the hollow cavity **80** of the valve housing **70**.

As shown in FIGS. **4–6**, the product tank **38** has a housing **90** defining a hollow chamber **92**. Inside the chamber **92** is a means for agitating **100** the product to evenly distribute the particulates throughout the liquid portion of the product. The agitating means **100** may be a shaft **102** having a plurality of paddles **104** attached thereon. The shaft **102** is rotated about a fixed axis thereby rotating the paddles **104**. The paddles agitate the product thereby preventing the accumulation of particulates in one area. This allows for a better flow of product through the outlets **106***a–b*.

As shown in FIGS. **7–8**, the sealing cone **24** has a cavity **10** for engaging with the linkage **26**. The sealing cone **24** has a cutting edge **112** which as described below, engages with the fill pipe to create a tight seal to prevent the dripping of product from the fill pipe onto the sealing areas of a container being processed along the conveyor means **42**. The sealing cone **24** also has a main body **114** with a pair of fins **116***a–b*.

As shown in FIGS. **9–10**, the fill pipe **22** has a circumferential recessed area **120** at its dispensing end **54**. The recessed portion **120** is created from a portion of the wall **52** of the fill pipe **22**. FIG. **11** shows the sealing cone in relation with the fill pipe **22**, and particularly, the circumferential recessed area **120** which engages the cutting edge **112** of the sealing cone **24**. The engagement of the cutting edge and the recessed area **120** prevents dripping of product from the fill pipe. It also cuts off any particulates that might hinder the tight sealing of the sealing cone **24** with the fill pipe **22**. If the seal between the sealing cone **24** and the fill pipe **22** is inadequate, then product may flow onto a container prior to proper positioning of the container under the fill pipe **22**. Such a scenario may lead to sealing problems with the container that would render the container defective. In particular, the packaging of soup for extended shelf life with refrigeration necessitates proper sealing of the container. The filling system **22** should not interfere with the sealing of a container of soup. FIG. **11** also shown the sealing cone engaged with the fill tube **22** with sealing cone **24***a* and cutting edge **112***a* fully retracted in a sealing position.

A packaging machine **200** is shown in FIG. **12** with the filling system **20** of the present invention thereon. The packaging machine **200** may have a PLC **60** for controlling not only the filling system **20**, but the other movements of components on the packaging machine **200**. A preferred control system is disclosed in U.S. Pat. No. 5,706,627 for a Control System For A Packaging Machine which is hereby incorporated by reference in its entirety, and which has the same assignee as the present application. The sealing station **204** is downline from the filling system **20** and thus dripping of product on a container would have an immediate effect on the sealing operation.

During processing, the carton bottom is first formed on a mandrel wheel and then the carton is placed on a conveyor mechanism. The conveyance of the cartons is indexed to the slowest operation, which is usually the top sealing operation. The cartons may be sterilized at a sterilization station, then conveyed to the filling system **20**. At the filling system **20**, each carton is lifted for bottom-up filling. Bottom-up filling involves the carton being lowered as it is filed to prevent sloshing of the product on the sealing areas. As shown in

FIGS. **13** and **13**A, the sealing areas **300** of the carton **40** are near the top and form the top fin **304** as shown in FIG. **14**. If a product, such as soup, splashes or drips on the sealing areas **300**, then a poor seal may result thus rendering the carton and product defective.

The present invention prevents splashing and dripping of the product onto the seal areas **300**. Once the filling of the carton **40** is completed, the sealing cone **24** is retracted by the control mechanism **28** via the linkage **26** thereby sealing the fill tube **22**. As the cutting edge **112** engages the circumferential recessed area **120**, any particulates that might have remained on the filling tube **22** are cut or crushed thereby allowing for a tight seal of the fill tube **22**. The dripping of product is prevented by the tight seal and splashing is prevented by the bottom-up filling process. The carton is then fully lowered onto the conveyor and conveyed to the top sealing station where the fin **304** is created on the carton **40**.

From the foregoing it is believed that those skilled in the pertinent art will recognize the meritorious advancement of this invention and will readily understand that while the present invention has been described in association with a preferred embodiment thereof, and other embodiments illustrated in the accompanying drawings, numerous changes, modifications and substitutions of equivalents may be made therein without departing from the spirit and scope of this invention which is intended to be unlimited by the foregoing except as may appear in the following appended claims. Therefore, the embodiments of the invention in which an exclusive property or privilege is claimed are defined in the following appended claims:

We claim as our invention:

1. A filling system for filling cartons with a liquid product with particulates therein, the cartons conveyed along a predetermined path, the filling system comprising:

a fill pipe disposed above the predetermined path, the fill pipe having an dispensing end and an inlet end, the dispensing end having a circumferential recessed portion;

a sealing cone having a linkage through the fill pipe to a control mechanism, the sealing cone having a cutting edge that mates with the circumferential recessed portion of the fill pipe;

a pump mechanism having a pump chamber and a transfer pipe in flow communication with the fill pipe;

a product tank for holding the liquid product with particulates, the product tank in flow communication with the transfer pipe and pump chamber; and

a knife-gate valve juxtaposed between the product tank and the transfer pipe, the knife-gate valve controlling the flow of liquid product with particulates from the product tank to the transfer pipe.

2. The filling system according to claim **1** wherein the product tank has means for agitating the liquid product with particulates.

3. The filling system according to claim **1** wherein the sealing cone has an open position for filling a carton and a closed position, the cutting edge engaged with the circumferential recessed portion of the fill pipe when the sealing cone is in the closed position.

4. The filling system according to claim **3** wherein the knife -gate valve has an open position and a closed position, the knife-gate valve in the closed position when the sealing cone is in the open position, and the knife-gate valve in the open position when the sealing cone is in the closed position.

5. The filling system according to claim **1** wherein the engagement of the cutting edge of the sealing cone and the circumferential recessed area of the fill pipe substantially prevents the flow of the liquid product with particulates from the fill pipe.

6. A packaging machine for forming, filling and sealing a series of cartons with a liquid product with particulates, the series of cartons conveyed along a carton path, the packaging machine comprising:

a first fill pipe and a second fill pipe, both disposed above the carton path, each of the first and second fill pipes having a dispensing end and an inlet end, the dispensing end having a circumferential recessed portion;

a first sealing cone having a linkage through the first fill pipe to a first control mechanism, the first sealing cone having a cutting edge that mates with the circumferential recessed portion of the first fill pipe;

a second sealing cone having a linkage through the second fill pipe to a second control mechanism, the second sealing cone having a cutting edge that mates with the circumferential recessed portion of the second fill pipe;

a first pump mechanism having a first pump chamber and transfer pipe in flow communication with the first fill pipe;

a second pump mechanism having a second pump chamber and transfer pipe in flow communication with the second fill pipe;

a product tank for holding the liquid product with particulates, the product tank in flow communication with the first transfer pipe through a first outlet and the product tank in flow communication with the second transfer pipe through a second outlet; and

a first knife-gate valve juxtaposed between the product tank and the first transfer pipe, and a second knife-gate valve juxtaposed between the product tank and the second transfer pipe, the knife-gate valves controlling the flow of liquid product with particulates from the product tank to the transfer pipes.

7. The packaging machine according to claim **6** wherein the first and second fill pipes fill adjacent cartons simultaneously.

8. The packaging machine according to claim **6** wherein the product tank has means for agitating the liquid product with particulates.

9. The packaging machine according to claim **6** wherein the fist and second sealing cones each has an open position for filling a carton and a closed position, the cutting edge of each of the sealing cones engaged with the circumferential recessed portion of each of the first and second fill pipes when each of the sealing cones are in the closed position.

10. The packaging machine according to claim **9** wherein the first and second knife-gate valves each has an open position and a closed position, the knife-gate valves in the closed position when each of the corresponding sealing cones is in the open position, and the knife-gate valves in the open position when each of the corresponding sealing cones is in the closed position.

11. The packaging machine according to claim **6** further comprising a first lifter and a second lifter, the lifters disposed below the carton conveyance means, the lifters lifting cartons about each of the fill pipes bottom-up filling.

12. The packaging machine according to claim **10** further comprising a PLC for controlling the opening and closing of the sealing cones and the knife-gate valves.

13. A method for filling a series of cartons with a liquid product having particulates, the series of cartons conveyed along a predetermined path of a form, fill and seal packaging machine, the method comprising:

opening a knife-gate valve juxtaposed between a product tank and a pump chamber, the product tank holding the liquid product having particulates, the opening of the knife-gate valve allowing for the liquid product having particulates to flow into the pump chamber through a transfer pipe;

closing the knife-gate valve;

opening a dispensing end of a fill pipe by lowering a sealing cone, the fill pipe in flow communication with the pump chamber through the transfer pipe;

pumping the liquid product through the pump chamber, the transfer pipe, the fill pipe and the dispensing end of the fill pipe and into a carton; and

closing the dispensing end of the fill pipe by actuation of the sealing cone to engage a cutting edge of the sealing cone with a circumferential recessed portion of the fill pipe after filling the carton.

14. The method according to claim **13** further comprising lifting a carton about the fill pipe for bottom-up filling of the carton with the liquid product having particulates.

15. A method for filling a series of cartons with a liquid product having particulates, the series of cartons conveyed along a predetermined path of a form, fill and seal packaging machine, the method comprising:

opening a knife-gate valve juxtaposed between a product tank and a pump chamber, the product tank holding the liquid product having particulates, the opening of the knife-gate valve allowing for the liquid product having particulates to flow into the pump chamber through a transfer pipe;

closing the knife-gate valve;

opening a dispensing end of a fill pipe by lowering a sealing cone, the fill pipe in flow communication with the pump chamber through the transfer pipe;

pumping the liquid product through the pump chamber, the transfer pipe, the fill pipe and the dispensing end of the fill pipe and into a carton; and

agitating the liquid product having particulates inside the product tank to distribute the particulates about the liquid of the liquid product.

16. The method according to claim **15** further comprising lifting a carton about the fill pipe for bottom-up filling of the carton with the liquid product having particulates.

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